U.S. DEPARTMENT OF COMMERCE
National Technical Information Service

PB-269 260

Bruin Lake, Tensas Parish, Louisiana

National Eutrophication Survey, Corvallis, Oreg

Prepared for

Corvallis Environmental Research Lab, Oreg

Mar 77

PB 269 260

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL EUTROPHICATION SURVEY

WORKING PAPER SERIES

CORVALLIS ENVIRONMENTAL RESEARCH LABORATORY - CORVALLIS, OREGON

and

ENVIRONMENTAL MONITORING & SUPPORT LABORATORY - LAS VEGAS, NEVADA

NATIONAL TECHNICAL
INFORMATION SERVICE

REPORT

ON

BRUIN LAKE

TENSAS PARISH

LOUISIANA

EPA REGION VI

WORKING PAPER NO. 532

WITH THE COOPERATION OF THE

LOUISIANA WILD LIFE AND FISHERIES COMMISSION

AND THE

LOUISIANA NATIONAL GUARD

MARCH, 1977

1. REPORT NO.

2.

3. RECIPIENT'S ACCESSION NO.

4. TITLE AND SUBTITLE

Report on Bruin Lake, Tensas Parish, Louisiana

5. REPORT DATE

Prepared March 1977

6. PERFORMING ORGANIZATION CODE

7. AUTHOR(S)

Anonymous (National Eutrophication Survey Staff)

8. PERFORMING ORGANIZATION REPORT NO.

Working Paper No. 532

9. PERFORMING ORGANIZATION NAME AND ADDRESS

National Eutrophication Survey
U.S. Environmental Protection Agency
P.O. Box 15027
Las Vegas, NV 89114

10. PROGRAM ELEMENT NO.

11. CONTRACT/GRANT NO.

12. SPONSORING AGENCY NAME AND ADDRESS

Office of Research and Development
U.S. Environmental Protection Agency
401 M Street, S. W.
Washington, DC 20460

13. TYPE OF REPORT AND PERIOD COVERED

Final - 1974

14. SPONSORING AGENCY CODE

15. SUPPLEMENTARY NOTES

Prepared in cooperation with the U.S. Environmental Protection Agency, Corvallis Environmental Research Laboratory, Eutrophication Survey Branch, Corvallis, OR 97330

16. ABSTRACT

Annual total phosphorus and total nitrogen loadings to the lake were estimated and subdivided according to either point or non-point source origin. An assessment of the lake's trophic condition and limiting nutrient is also provided. All data collected by the U.S.E.P.A. National Eutrophication Survey during the one year study of the lake and its tributaries are included in the report.

17. KEY WORDS AND DOCUMENT ANALYSIS

DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
eutrophication lakes nutrients phosphorus nitrogen loading		05B 05C

18. DISTRIBUTION STATEMENT

Release unlimited

19. SECURITY CLASS (This Report)

20. SECURITY CLASS (This Page)

21. NO. OF PAGES

26

22. PRICE

EPA Form 2220-1 (9-73)

REPORT ON BRUIN LAKE

TENSAS PARISH, LOUISIANA

EPA REGION VI

by

National Eutrophication Survey

Water and Land Monitoring Branch
Monitoring Applications Laboratory
Environmental Monitoring & Support Laboratory
Las Vegas, Nevada

and

Eutrophication Survey Branch
Corvallis Environmental Research Laboratory
Corvallis, Oregon

Working Paper No. 532

OFFICE OF RESEARCH AND DEVELOPMENT
U.S. ENVIRONMENTAL PROTECTION AGENCY

March 1977

CONTENTS

	Page
Foreword	ii
List of Louisiana Study Lakes	iv
Lake and Drainage Area Map	v
Sections	
I. Introduction	1
II. Conclusions	1
III. Lake Characteristics	3
IV. Lake Water Quality Summary	4
V. Literature Reviewed	9
VI. Appendices	10

FOREWORD

The National Eutrophication Survey was initiated in 1972 in response to an Administration commitment to investigate the nationwide threat of accelerated eutrophication to freshwater lakes and reservoirs.

OBJECTIVES

The Survey was designed to develop, in conjunction with state environmental agencies, information on nutrient sources, concentrations, and impact on selected freshwater lakes as a basis for formulating comprehensive and coordinated national, regional, and state management practices relating to point source discharge reduction and nonpoint source pollution abatement in lake watersheds.

ANALYTIC APPROACH

The mathematical and statistical procedures selected for the Survey's eutrophication analysis are based on related concepts that:

a. A generalized representation or model relating sources, concentrations, and impacts can be constructed.

b. By applying measurements of relevant parameters associated with lake degradation, the generalized model can be transformed into an operational representation of a lake, its drainage basin, and related nutrients.

c. With such a transformation, an assessment of the potential for eutrophication control can be made.

LAKE ANALYSIS

In this report, the first stage of evaluation of lake and watershed data collected from the study lake and its drainage basin is documented. The report is formatted to provide state environmental agencies with specific information for basin planning [§303(e)], water quality criteria/standards review [§303(c)], clean lakes [§314(a,b)], and water quality monitoring [§106 and §305(b)] activities mandated by the Federal Water Pollution Control Act Amendments of 1972.

Beyond the single lake analysis, broader based correlations between nutrient concentrations (and loading) and trophic condition are being made to advance the rationale and data base for refinement of nutrient water quality criteria for the Nation's freshwater lakes. Likewise, multivariate evaluations for the relationships between land use, nutrient export, and trophic condition, by lake class or use, are being developed to assist in the formulation of planning guidelines and policies by the U.S. Environmental Protection Agency and to augment plans implementation by the states.

ACKNOWLEDGMENTS

The staff of the National Eutrophication Survey (Office of Research and Development, U.S. Environmental Protection Agency) expresses sincere appreciation to the Louisiana Wild Life and Fisheries Commission, Division of Water Pollution Control for professional involvement, to the Louisiana National Guard for conducting the tributary sampling phase of the Survey, and to those Louisiana wastewater treatment plant operators who provided effluent samples and flow data.

Robert A. Lafleur, Chief; J. Dale Givens, Assistant Chief; Lewis R. Still, Biologist; Louis Johnson, Biologist; Lee Caubarreaux, Biologist; Darrell Reed, Engineer; Dempsey Alford, Biologist; and Elwood Goodwin, Water Quality Control Technician, all of the Louisiana Wild Life and Fisheries Commission, Division of Water Pollution Control reviewed the preliminary reports and provided critiques most useful in the preparation of this Working Paper Series.

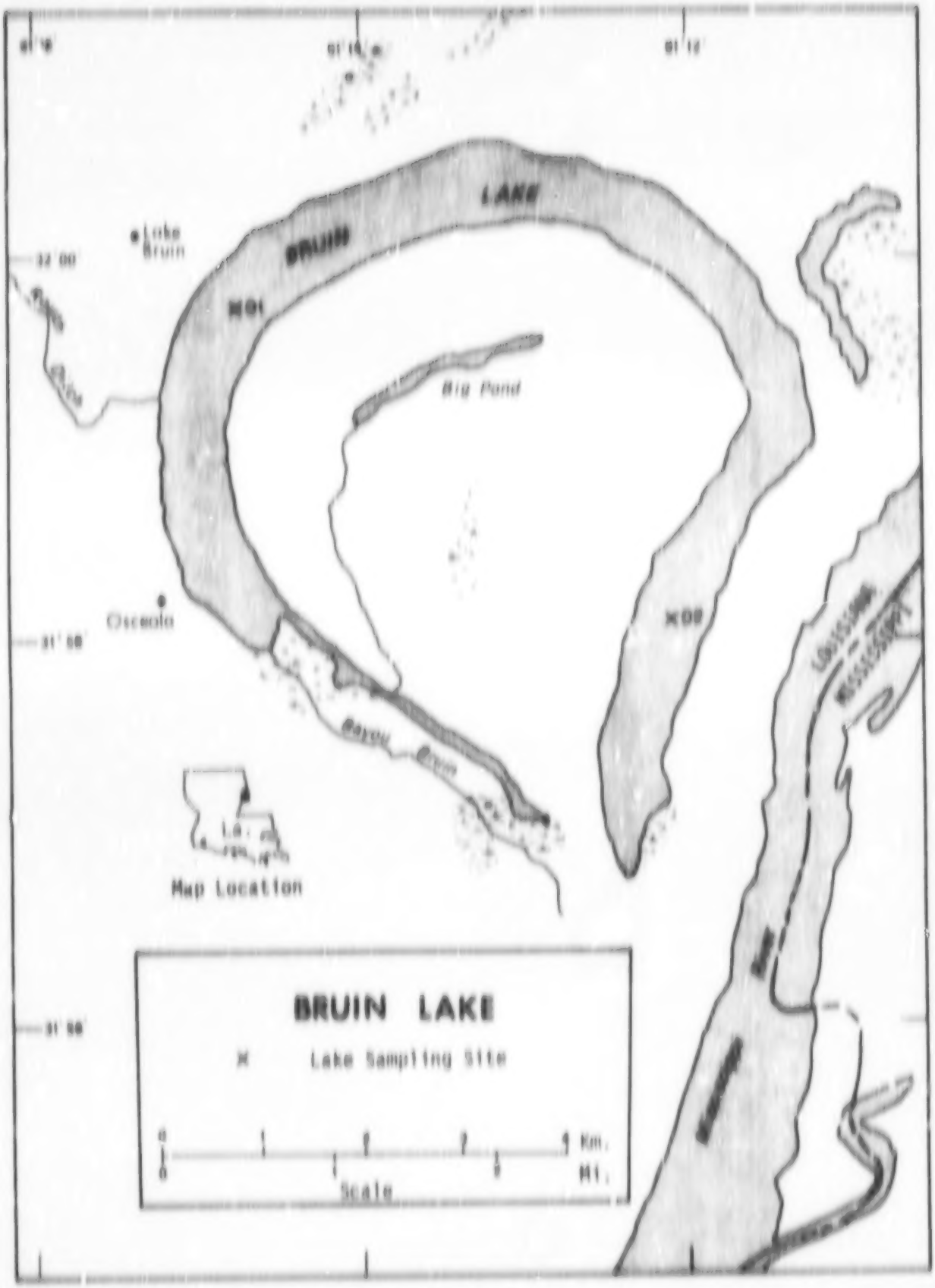
Major General O'Neil Daigle, Jr., the Adjutant General of Louisiana, and Project Officer Colonel Lawrence P. Dupre, who directed the volunteer efforts of the Louisiana National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

NATIONAL EUTROPHICATION SURVEY

STUDY LAKES

STATE OF LOUISIANA

LAKE NAME	PARISH
Anacoco Lake	Vernon
Lake Bistineau	Bienville, Webster
Black Bayou	Caddo
Black Lake	Natchitoches and Red River
Bruin Lake	Tensas
Bundicks Lake	Beauregard
Caddo Lake	Caddo (Menon and Harrison in Texas)
Cocodrie Lake	Concordia
Cocodrie Lake (Lower)	Rapides
Concordia Lake	Concordia
Cottle Lake	Rapides
Cross Lake	Caddo
D'Arbonne Lake	Union
False River Lake	Pointe Coupee
Indian Creek Reservoir	Rapides
Saline Lake	LaSalle
Turkey Creek Lake	Franklin
Lake Vernon	Vernon
Lake Verret	Assumption


LAKE
BRUIN
Lake Bruin
Big Pond
Osceola
Bayou Bruin
Map Location
BRUIN LAKE
Lake Sampling Site
Km.
Mi.
Scale

REPORT ON BRUIN LAKE, LOUISIANA

STORET NO. 2202

I. INTRODUCTION

Bruin Lake was included in the National Eutrophication Survey (NES) as a water body of interest to the Louisiana Stream Control Commission and Louisiana Wild Life and Fisheries Commission. Tributaries and nutrient sources were not sampled, and this report relates only to the data obtained from lake sampling.

II. CONCLUSIONS

A. Trophic Condition:[a]

Bruin Lake is classified as eutrophic i.e., nutrient rich and highly productive based upon Survey data. Whether such nutrient enrichment is to be considered beneficial or deleterious is determined by its actual impact upon designated beneficial water uses of each lake.

Potential for primary production as measured by algal assay control yield was high, and Secchi disc visibility was low. Dissolved oxygen levels were depleted below 9 meters during summer sampling at Station 01. Chlorophyll a levels ranged from 10.7 ug/l in the spring to 22.9 ug/l in the summer with a mean of 16.4 ug/l.

[a]See Appendix C.

Of the 19 Louisiana lakes sampled by NES in 1974, 11 had higher median total phosphorus values, 9 had higher median orthophosphorus, and only 3 had higher medial total inorganic nitrogen levels.

B. Rate-Limiting Nutrient:

Spring algal assay results suggest that Bruin Lake was nearly colimited by available phosphorus and nitrogen levels. Spikes with phosphorus or nitrogen alone resulted in increases in assay yield, and maximum response was achieved with the simultaneous addition of both nutrients. The lake ratios of inorganic nitrogen to orthophosphorus (N/P) suggest phosphorus limitation in spring and fall, and nitrogen limitation during the summer.

III. LAKE CHARACTERISTICS

A. Lake Morphometry:*

A. Surface area: 9.48 km^2.
B. Mean depth: 9.1 meters.
C. Maximum depth: 18.0 meters.
D. Volume: 86.177 x 10^6 m^3.

B. Precipitation:

A. Year of sampling: 155.8 cm.
B. Mean annual: 127.5 cm.

*Provided by the State of Louisiana.

IV. LAKE WATER QUALITY SUMMARY

Bruin Lake was sampled three times during the open-water season of 1974 by means of a pontoon-equipped Huey helicopter. Each time, samples for physical and chemical parameters were collected from two stations on the lake and from one or more depths at each station (see map, page v). During each visit, depth-integrated samples were collected from each station for chlorophyll a analysis and phytoplankton identification and enumeration. During the first and last visits, 18.9-liter depth-integrated samples were composited for algal assays. Maximum depths sampled were 11.6 meters at Station 01 and 9.1 meters at Station 02. For a more detailed explanation of NES methods, see NES Working Paper No. 175.

The results obtained are presented in full in Appendix B and are summarized in IV-A for waters at the surface and at the maximum depth for each site. Results of the phytoplankton counts and chlorophyll a determinations are included in IV-B. Results of the limiting nutrient study are presented in IV-C.

B. Biological Characteristics:

1. Phytoplankton -

Sampling Date	Dominant Genera	Algal Units per ml
03/19/74	1. Melosira	1,189
	2. Cryptomonas	743
	3. Dactylococcopsis	520
	4. Ankistrodesmus	297
	5. Micractinium	297
	Other genera	1,191
	Total	4,237
05/30/74	1. Dactylococcopsis	24,829
	2. Nitzschia	13,770
	3. Anabaenopsis	3,802
	4. Oscillatoria	2,271
	5. Melosira	1,977
	Other genera	5,640
	Total	52,369
11/11/74	1. Dactylococcopsis	4,945
	2. Oscillatoria	2,448
	3. Flagellates	832
	4. Nitzschia	715
	5. Cryptomonas	685
	Other genera	4,084
	Total	13,709

2. Chlorophyll a -

Sampling Date	Station Number	Chlorophyll a (ug/l)
03/19/74	01	13.5
	02	10.7
05/30/74	01	22.9
	02	20.9
11/11/74	01	13.4
	02	16.7

C. Limiting Nutrient Study:

1. Autoclaved, filtered, and nutrient spiked -

Spike(mg/l)	Ortho P Conc.(mg/l)	Inorganic N Conc.(mg/l)	Maximum Yield (mg/l-dry wt.)
Control	0.020	0.222	3.6
0.05 P	0.070	0.222	4.9
0.05 P + 1.0 N	0.070	1.050	11.7
1.00 N	0.020	1.222	4.3

2. Discussion -

The control yield of the assay alga, Selenastrum capricornutum, indicates that the potential for primary production in Bruin Lake was high at the time of spring sample collection. Spikes with phosphorus or nitrogen alone resulted in slight increased yield, suggesting near-colimitation by the two nutrients. Maximum growth response was achieved with the simultaneous addition of both phosphorus and nitrogen.

It should be noted that significant chemical changes took place in Louisiana lake samples between collection and algal assay.

the assay data should be considered in this context and until such differences are resolved, used with caution for any prediction of actual lake conditions. Such chemical changes are likely to alter the assay control yield as well as modifying the N/P ratios.

The autumn algal assay results have not been included in this report as the substantial changes in nutrient levels have removed their information value.

The N/P ratios in the spring and fall lake chemistry samples were respectively 16/1 and 33/1, indicating phosphorus limitation at those times. The N/P ratio was 7/1 for the summer lake samples, indicating nitrogen limitation (an N/P ratio of 14/1 or greater generally reflects phosphorus limitation).

V. LITERATURE REVIEWED

U.S. Environmental Protection Agency. 1975. National Eutrophication Survey Methods 1973-1976. Working Paper No. 175. National Environmental Research Center, Las Vegas, Nevada, and Pacific Northwest Environmental Research Laboratory, Corvallis, Oregon.

VI. APPENDICES

APPENDIX A
CONVERSION FACTORS

CONVERSION FACTORS

Hectares x 2.471 = acres

Kilometers x 0.6214 = miles

Meters x 3.281 = feet

Cubic meters x 8.107×10^{-4} = acre/feet

Square kilometers x 0.3861 = square miles

Cubic meters/sec x 35.315 = cubic feet/sec

Centimeters x 0.3937 = inches

Kilograms x 2.205 = pounds

Kilograms/square kilometer x 5.711 = lbs/square mile

APPENDIX B

PHYSICAL AND CHEMICAL DATA

[illegible]

APPENDIX C

PARAMETRIC RANKINGS OF LAKES SAMPLED BY NES IN 1974

STATE OF LOUISIANA

LAKE DATA TO BE USED IN PROGRAM

LAKE CODE	LAKE NAME	[illegible] TOTAL P	[illegible] INORG P	[illegible] MEAN SEC	[illegible] DEPTH	[illegible] M	[illegible] CONC INFLOW P
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